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OPENING ADDRESS *of the* PRESIDENT *of* SECTION F (ECONOMIC SCIENCE *and* STATISTICS), *of the* BRITISH ASSOCIATION *for the* ADVANCEMENT *of* SCIENCE, *at the* THIRTY-EIGHTH MEETING, *at* NORWICH, *August*, 1868. *By* SAMUEL BROWN, ESQ., F.S.S., *President of the Institute of Actuaries.*

IN the able and eloquent addresses which have been given in preceding years at the opening of this Section, the nature and objects of the divisions of science, in which we are more especially concerned, have been so clearly pointed out, that I do not propose to occupy your time with definitions and reflections, but rather to take a hasty view of the principal questions which, since our last meeting, have come prominently before the public, and which are likely more especially to interest the students of our science.

Whether under the head of Economic Science or Statistics, the range of subjects is so wide, the interest so intense, and their importance to the public so vast, that it is almost as difficult to select, as it would be to confine within proper limits the full history of the past year. Thought is so busy, and civilisation (if we may use the term generally to indicate an improvement in the social condition of nations) advancing with such rapidity, that new subjects are continually thrusting themselves into notice and discussion by the different classes whom they most affect. It is essential, however, to make choice of a few leading features, and one topic which has during the past year, and is now exciting a very lively interest, is that of technical education.

Technical Education.

A very strong impulse has been given to the discussion of this question by the various comparisons of the World's industry, which, ever since the Great Exhibition of 1851, the success of which was so much owing to the far-seeing intellect and earnest purpose of the lamented Prince Consort, have enabled all nations to measure their respective progress in science and art, by the actual results of their manufactures and industries in every branch. Many persons have expressed alarm lest other nations which have discovered their deficiencies, and have set to work with energy and determination to remove them, should leave this country behind in their applications of knowledge, by introducing and maintaining a more practical, if not a higher standard of general education amongst the people. Without going too far back to the frequent discussions to which this subject has given rise, it will be sufficient to refer to the report of the committee appointed by this Association to consider the best means for promoting scientific education in schools, which was presented at the last meeting at Nottingham. The committee admit the existence of a general and even national desire to facilitate the acquisition of some scientific knowledge by boys at our public and other schools; and a very interesting account is appended of the progress which has already been made in Oxford, Cambridge, the University of London, and the College of Preceptors, as compared with the French and German schools. The conclusions of the report are highly practical, and recommend that in all schools natural science should be taught; that at least three hours a-week should be devoted to such scientific instruction; that as to honours and prizes, it should be placed on an equal footing with mathematics and modern languages; that universities and colleges should be invited to make it a subject of examination, and that the importance of appointing lecturers, and offering entrance scholarships, exhibitions, and fellowships, should be represented to the authorities of colleges.

No mention is here made of the extent to which, or the mode by which, the Government might be called upon to aid in improving the technical education of the country. In the early part of this year, however, a conference, called by the Society of Arts, brought together a great number of the most eminent statesmen, men of science, teachers, and representatives of manufactures and commerce, by whom this important subject was for two days discussed under all its varied aspects. It would be invidious to mention names, when nearly all the distinguished thinkers who have so long worked for the educational improvement of the people, contributed their part to the discussion. The resolutions were general, giving only the broad outlines of the opinion of the meeting, as it was intended to appoint a sub-committee to carefully examine and report on the details.

The report of the committee, which was not delivered in till the 21st of July last, states that the conclusions they had arrived at were in substance, that technical education, as referred to them, excludes the manual instruction in art given in the workshop, rather meaning general instruction in those sciences, the principles of which are applicable to the various employments of life. It should be given, not in separate professional institutions, but in those for general education. It is desirable that schools should be established, having for their main object the teaching of science as a mental discipline. It is necessary to introduce scientific teaching in all secondary schools. The higher scientific instruction should be tested by public examinations, and the proficiency of the students certified by diplomas. In detailing the course of instruction for certain businesses, such as agriculture and gardening, chemical manufactures, metallurgy, mining, civil engineering, mercantile marine, that of the naval architect and marine engineer, the mechanical engineer and machinist, the architect, and the merchant, the scientific instruction should be followed by practical pupilage in efficient workshops or establishments. A great advance in technical education might be expected, if the employers of labour would generally give the preference to those who produce evidence of having been adequately instructed in the sciences applicable to their particular occupations.

These are practical suggestions, but the question itself opens up nearly all the points or theories to which the discussion of the general education of a people has given rise. Is it to be expected that ignorance would seek for instruction of its own accord? If scientific instruction is to be brought down to the lower class of labourers, by what means shall the parent who prefers utilising the manual labour of his child at an early age, be compelled to spare him for the higher duty of instruction in order that he may be enabled to earn more for himself hereafter.

It seems admitted, that if better instruction is given in the secondary schools, it must also be improved in the primary, as there is evidence to show that there is little disposition in scholars to take to the higher class of learning without having received the elements of it at least in the earlier stage. It is also proposed that children should remain longer at school. How will this affect the labour market, and will the greater skill acquired compensate for the delay?

The attempts which have been hitherto made to bring lectures and laboratories within reach of the working classes, do not appear to have been very successful, nor, as a general rule, do the employers of labour, who, we should imagine, would most benefit by the increased intelligence of their workmen in their special art, give much encouragement to the efforts of those who have so patriotically devoted themselves to this object. In Cornwall, the mining institution failed in its expected effects by the original defective education of the working classes, who, unable to read easily, or to take notes, or to do the simple arithmetic required for the calculation of the percentage of ores, soon grew tired of lectures they could not follow with interest. Professor Huxley points out, that the School of Mines, in Jermyn Street, was not established by the mining interests, but by the eminent geologist Sir H. De la Beche, and that very few pupils attended until recently, when by the offer of pecuniary rewards and medals, and the prospect of appointments hereafter, 600 or 700 average papers were sent in for competition in some branches of science, and 1,200 or 1,300 in chemistry. This seems to indicate the right method by which the friends of technical education might stimulate the classes to whom the higher rewards are not accessible. Associations might be formed, so that in the various branches of study the united subscriptions would allow of studentships being given, tenable for three or four years. By these means the young workman, or even one more advanced in life, may not only gain the reward of his ability, but obtain some compensation for the diminished wages which may temporarily follow the giving up a portion of his time to increase his skill hereafter. The employers of labour of all kinds, but especially those in which the higher ability required renders a considerable premium only a fair price for admission to the business, might tempt many from the overcrowded professions, by a judicious offer of remitting the premiums where high distinction has been gained. Probably the cost to themselves would be in many cases soon more than compensated by the higher theoretical knowledge brought earlier into use.

In connection with this subject, it is impossible not to feel that the munificent gift of Mr. Whitworth deserves the heartfelt gratitude of the nation. What effects will be produced by thirty scholarships of the annual value of 100*l.* each, in a single branch of applied science so important to this country as engineering and mechanical industry, it is difficult to calculate. Not merely the succession of new aspirants every three years, but the numbers who, though falling a little short of the splendid prize, will yet have given all their powers of mind to obtain it, may be expected to create an impulse and maintain a mental activity which will not allow England to fall behind in her continental rivalship. It is not to be expected that many individuals can offer singly so noble and patriotic a gift, but they may combine together, and thus, by the union of isolated efforts, institute similar rewards for proficiency in other arts or occupations. That there is amongst our industrial classes a large number of intelligent and skilled workmen, with ability to compete for similar prizes, may be seen in the admirable volume of reports of the artisans, selected by the Society of Arts to visit the Paris Exhibition, and published by the society. The deep knowledge of their particular industry, the general keenness of observation, the common sense, and in many cases talented style of writing, besides the variety of the contents, make it a volume of remarkable interest, highly creditable to the class from whom they were selected.

In the higher branches of science, the universities, colleges, and great schools, with their wealthy endowments, will be called upon to move with the times; and there are signs of their already preparing to respond in a suitable manner to the voice of the nation. The offer of fellowships, scholarships, and exhibitions, may be made to suit all grades of scientific requirements. Though it may sensibly diminish the number of classical rewards, it is probable that it would not really lower the high standard of classical excellence in the country, whilst it would raise up a fresh career in which renown may be won. Many who by other inclinations may not be the first in classical studies, may achieve a world-wide fame for the university or college of their choice, by their attainments in science instead.

In what manner the Government may best be able to second the efforts of the friends of education, is as yet undecided. Some suggest that they should establish secondary, or higher schools, in the locality of a particular industry, and adapt the teaching to the special wants of the population around. But the question arises, are these schools to be founded in places where no special desire is felt for the higher instruction offered, or in other places where the voluntary efforts either of the masters or workmen, or both, only require additional aid to render them effective? It may be said, that the former need it most, for how are we to overcome ignorance or apathy, if the State will not be at the expense of exciting at least a desire for improvement, and teaching the people the advantages and pleasures of knowledge. On the other hand, are those who have proved their earnestness by pecuniary sacrifices to be left to struggle on feebly, whilst others who are indifferent to scientific education, have it brought to their doors? Others again, consider that schools for special science, at any rate for the labouring classes, have generally failed of success, and that the best plan is to improve education generally, giving it a higher tone, both in the primary and secondary schools, and making science more a part of the general study, but with special application of it for the pupils of more advanced ages.

The evidence in the Report of the Select Committee of the House of Commons on the subject, which has recently appeared, gives an encouraging view of the practical skill of our workmen in nearly all branches of industry, leaving no reason to fear the rivalry of foreigners in mere handicraft. But the competition in commerce and manufactures is so close in the markets of the world, that the superior technical education of the continental workman, enabling him to adopt so readily any new processes or improvements, gives him manifest advantages over the English workman. It is essential for our industrial classes to be better instructed in science and its applications, and be less liable to fail by clumsy inventions and costly errors.

On the whole it would seem, that the action of the Government will be most beneficially exerted in the first instance by extending the system of grants in aid of local exertions, by adding to the emoluments of teachers who produce evidence of the higher class of instruction having been efficiently imparted, and by aiding in the cost of building where new schools of a special scientific character are needed. Above all, the stimulus of endowments or exhibitions of adequate value, or the offer of Government appointments in such departments as science can be most usefully applied in, will probably produce the most profitable results for a national expenditure.

Labour and Capital.

Another subject, vitally connected with maintaining the position of this country in its competition abroad, as well as with its peace and prosperity at home, is the relation of wages to capital. For many years the most violent discussion has been going on; but it really appears as if some progress has been made during the past year in an amicable solution of the difficulty. The opinion that labour and capital must be in antagonism, each trying to subdue the other to its own terms—an opinion which can only be entertained in complete ignorance of their relative functions—is becoming gradually undermined, and the earnest efforts of some of the most practical and enlightened employers of labour, aided by the increased intelligence and better feeling produced by conciliation on the working classes, have allowed some important experiments to be fairly tried to reconcile the two opposing foes, and to bring them into harmonious working together. It is true the beginning is feeble, and what is accomplished, small, compared with what remains to be done. It is now generally admitted that a better knowledge of the principles of political economy, and of the laws which regulate wages and capital, the production and distribution of wealth, would be beneficial to all parties. A most influential general committee has been formed under the auspices of the National Association for the Promotion of Social Science. In an evening meeting, at which the Right Hon. W. E. Gladstone presided, the question was debated, and certain general principles laid down for the course of proceeding. But the work to be accomplished is of the most laborious character. The mass of prejudice to be overcome on both sides is the growth of years, and it yet remains to be seen how the interference of a third party, though professing to represent impartially the interests of the public, and the true principles of economic science, will be received by either. It is to be hoped, at any rate, that the clumsy and barbarous system of strikes and locks-out, which destroy both the small savings of the workmen and the capital out of which he hopes to increase his wages, and which keep up a perpetual source of irritation and ill-feeling, will be abolished as an insensate and reckless process. Trades' unions are contended for by some as useful and effective, if not carried on to the injury of the trade, or to the detriment of the nation, and provided the members pursue their own objects without undue coercion of others. But without coercion and oppression how can they fulfil their objects? The limitation of times of labour, the depression of the sober, industrious, and most skilful workman to an average level of the more idle and unskilful, the exclusion of apprentices, and the dire effects in other branches of the trade or manufacture in which, without wishing to strike themselves, the workmen are dependent on the continued labour of others, who will not work, naturally drive capital away into other countries or other trades, and thus leave the infatuated workman with worse prospects of success than when he began the strike. Nor can we pass over the selfishness with which one branch of occupation frequently pursues this system of strikes without reference to others, who, though unwilling to throw up their employments, are forced into unprofitable idleness, misery, and want that other classes may better themselves by higher wages. The whole of this false and dangerous system must be superseded by some other scheme or schemes which will unite in harmonious working labour and capital. It is not necessary that there should be but one remedy. The excesses of the working classes of France in the Revolution of 1848, and their vote to expel the English workmen, led to the indignant remonstrances of the French political economists, and eventually to the institution of the Conseil des Prud'hommes, courts of arbitration, and industrial partnerships, which have had the happiest effects. In France, in the ten years 1830-40, Mr. Mundella informs us the courts of arbitration have adjudicated on 135,730 cases, of which 128,319 were amicably settled; 3,530 withdrawn by consent; 3,881 judgments pronounced, from which there were only 155 appeals. In Nottingham especially, according to the testimony of Mr. Mundella, the working of the board for seven years up to the present time, has been most favourable, and in the highest degree satisfactory both to the employers and the employed. The board consists of an equal number of masters and workmen on each side, with a president chosen by consent, and for three years and a-half they have been enabled to agree on all points in debate without the necessity of coming to a vote. The system has recently been extended to Hawick, North Britain, and to the Potteries. The Council of the Amalgamated Trades' Unions passed a resolution, desiring the establishment of these boards, in all branches of their union, and there seems little doubt that the courteous and kindly meeting together to settle in common questions which were formerly sources of hostility and irritation, would, if introduced in all trades, have a wonderful effect in uniting two classes so essentially necessary to each other as the capitalist and the labourer.

But there appears to be even a more powerful mode of co-operation, because it appeals more directly to the self-interest of the working classes, viz., industrial partnerships, in which the masters and workmen may unite together. Co-operative stores imply a combination of consumers to cheapen the price of articles purchased, but their tendency is naturally to dispense with the class of dealers or middlemen, and by the saving of the profits formerly gained by them, the consumers benefit at the cost only of the relatively small expenses of managing the stores. But what would become of the class of dealers or tradesmen, if this principle was generally acted upon? In admitting the workmen into partnerships of production, the greater part of the difficulties between labour and production seem to vanish. As every one of the partners is interested in increasing the profits, he can have no wish to stint his own labour, or to check in any way the labour of others. He not only is careful not to waste the materials himself, but he keeps a vigilant eye that his fellow workmen may be equally careful. He is led to understand the accounts of a firm, and the causes of depression and prosperity of trade. Strikes frequently occurred when from the closeness of foreign competition the market could least bear them; the workman, when a partner, sees that at such times his profits would be diminished by any check to, or increased price of, labour.

The most remarkable and encouraging example of the new system, was given in a paper by Mr. Briggs, read before the Social Science Committee of May last, on the Whitworth collieries. In ten years there had been four strikes, involving cessation of work for seventy-eight weeks. During the whole of that period the annoyance and anxiety of the partners were extreme. The profits were reduced to little more than 5 per cent. on their invested capital. They were compelled to evict families from their cottages, in order to introduce new labourers for their works. The police were required in large numbers for the protection of the non-union men. At last the painful struggle terminated in a riot in the village, the ringleaders of which were convicted at the York Assizes in 1863. But in 1864 the proprietors determined to take the whole of the men into partnership, and a limited liability company was formed from 1st July, 1865, of which they retained two-thirds of the capital, the remainder being allotted in shares to be purchased by the men. After paying a moderate rate for wages and management, and the proper allowance for reserves and depreciation, any excess over 10 per cent. of the profits was to be allotted half to the capital, and the other half as a bonus to the workmen in proportion to their earnings. At first they were suspicious, but the plan succeeded so well, that in the very first year the dividend was 12 per cent., and the 2 per cent. which was allotted as a bonus on wages, allowed of an average increase of 7½ per cent. to the workpeople on their earnings. In the second year, 80 per cent. of the workmen took shares, the profits were 13 per cent., and the 3 per cent. bonus allowed an average increase of 10 per cent. on the workmen's earnings, besides setting by 9 per cent. on the capital as a reserve fund. The village has been perfectly peaceful, the workpeople have become sober, industrious, and respectable in their conduct, and they generally invest their profits in the extension of the business. There has been no dispute and no charge of neglect of work made. This is not a small experiment, 1,200 men and boys have benefited by the operation, and 90,000*l.* of capital is invested in the concern.

With modifications adapted to different trades, this system seems worthy of a wide extension. The proper rate of bonus for labour must, no doubt, depend on the proportion which the labour bears to the other costs of production and of bringing the article to market. Competition of foreign countries, variations in supply and demand, may prevent wages bearing a fixed proportion to the other capital required, consequently the bonus to wages may have to be adjusted in different manufactures or trades. But some of the best of the trades' unions have declared themselves in favour of the trial of this scheme, and the commercial greatness of England is deeply interested in its success.

Insurance.

Leaving subjects still so full of doubts and difficulties, we turn to one which, though established upon laws of nature equally recondite, has been pushed into practice with an energy and success highly creditable to this country. It would be inexcusable in this city, in which have been founded two amongst the greatest and most enterprising of our insurance companies, which under the able management of Sir Samuel Bignold, one of the vice-presidents of this Section, have obtained so wide a reputation, and to whose representative in London, Mr. C. J. Bunyon, we are indebted for the best works which have appeared on the law of fire and life assurance, not to allude to the progress which these valuable institutions have made in this country. Vital statistics are now assuming a form which enable the most complicated problems of human life to be dealt with as if they were certain and simple events. Yet little more than a century has elapsed since the Attorney and Solicitor-General of that day, when reporting on the application for a royal charter to the first society formed on scientific principles for the assurance of life, objected to it on the ground that its success must depend on calculations taken on tables of life and death, whereby the chance of mortality is attempted to be reduced to a certain standard. "This is a mere speculation," they observe, "never yet tried in practice, and consequently subject, like all other "experiments, to various chances in the execution." Further, considering that the general tables include both healthy and unhealthy lives, they thought that "the register of life and death "ought to be confined, if possible, for the sake of exactness, to "such persons only as are the objects of insurance." It was argued, to show the small probability of success for the society, that the Royal Exchange Assurance, in forty years, had taken only 10,915*l.* in premiums, of which the profits amounted to only 2,651*l.*, must have been nearly exhausted in the charges of management. They would hardly expect a more considerable capital to arise from lower premiums, and the hazard of loss will be increased in proportion as the dealing will be more extensive. The petition was dismissed, but the society (the Equitable) was formed, and in spite of the gloomy prognostications at its birth, had afterwards, at one time, nearly 20,000,000*l.* of assurances on lives in force together. About six years back, from an estimate made on a large proportion of the companies in the United Kingdom, it was computed that about 372,000,000*l.* were assured upon lives; and at the rate of progress made of late years, it is probable that this is now increased to 400,000,000*l.* But a still more remarkable extension of this kind of business has, within a few years, taken place within the United States of America. At the close of 1866, thirty-nine companies doing business in the State of New York, had about 305,390 life policies in force for upwards of 173,000,000*l.*, which at the end of 1867 had increased to 403,841 policies for 233,400,000*l.* A single company, the Mutual of New York, had issued in that one year 19,406 policies for 12,450,000*l.*, taking in new premiums upwards of 801,000*l.* The assurances in that company alone amounted to nearly 39,000,000*l.*, being almost three times the amount at present existing in our largest office in this country.

Considering the great pecuniary interests at stake, the discovery of the true law of mortality is of deep importance. The theory of that eminent mathematician, Benjamin Gompertz, F.R.S., that there is in the human frame a power to oppose destruction, which loses equal proportions in equal times, and consequently that the intensity of mortality is represented by a series in geometrical progression, was founded upon actual observations of numerous tables. Such a theory is congruous with many natural effects, as for instance, the exhaustions of the receiver of an air-pump by strokes repeated at equal intervals of time, and it has been confirmed for long periods of life in most of the tables of original observations which have been made. There is a marked difference, however, in the constants of mortality in three principal periods of life—childhood, manhood, and old age. There are also exceptional or climacteric years of life, and from the variety of circumstances which may affect health or life, such as occupation, locality, habits, exposure to disease, &c., so many peculiarities in each class of observations, which themselves may have been incorrectly or imperfectly collected, that it is very difficult to detect in any what may be called the true or universal law of mortality.

A very important inquiry is now being made, under the auspices of the Institute of Actuaries, into the actual experience of some of the older companies. The facts relating to 147,000 persons admitted after medical examination as healthy lives, of whom about 24,000 had died, afford ample materials for many interesting deductions in vital statistics, and are especially valuable for the accuracy of the records. A similar investigation is being made in Germany and in the United States of America, conducted by scientific institutions of a like character, and by some of the leading mathematicians of those countries.

It is to be regretted that no authentic information as to the total amounts insured in various branches is known in this country. In fire insurance a rough estimate, deduced from the duty, would give about 1,445,000,000*l.* in 1867, including nearly 80,000,000*l.* on farming stock. The total amount of marine insurance business is equally uncertain, though it must be increasing with the rapid strides of commercial enterprise. Mr. Morris Black, in his analysis of the accounts of marine insurance companies established since 1859, gives the premiums received by eleven of these companies in 1867 as nearly 2,800,000*l.*, insuring about 227,000,000*l.*; but this does not include the five oldest and largest companies, nor the great amount underwritten by the members of Lloyd's. The total value of shipping and commercial products liable to risk in voyages between different ports would be the more interesting, as the Statistical Committee of Lloyd's have for the last two years, by the aid of their honorary secretary, Mr. Jeula, collected and compared some of the most striking results of the accidents and losses in which, as a great maritime nation, we take so great a share. In

10,587 vessels in 1866, to which accidents of some kind happened, and 11,424 vessels in 1867, the accidents of different kinds, whether sailing vessels or steamers (the latter being about 10 per cent. of the total), show a remarkable regularity in the percentage, and indicate the value of a more extended inquiry. The tables comprise losses and casualties in all parts of the world, and are divided into thirty-one geographical sections, for the voyages between the ports in each section. With these and the annual wreck registers of the Board of Trade for the dangers nearer our own coasts, and fuller statistics from our own and foreign countries, on a uniform plan, of the amount and value of shipping and cargoes passing from port to port in different trades, we may expect a great increase in our general knowledge on these subjects.

At the Statistical Congresses held in Paris in 1855, and at Berlin in 1863, it was recommended to collect the statistics of all branches of insurance, in such a form that the progress of nations therein might be compared. The heads of the Government Statistical Departments of several countries are now engaged in maturing a plan for comprehending these and other commercial statistics in a full report.

Electric Telegraphs.

One of the most important aids to the social and commercial progress of any country, is the facility in the means of personal intercourse, and especially of frequent communications by post and verbal messages. Good roads and railroads, giving rapid and cheap means of transport both for passengers and goods, are essential to the increase of internal trade. But equally essential is the power of sending swift and accurate messages, and receiving prompt and correct replies. The annual extension of the postal and telegraph system, is a striking proof of the mental activity and growth of the internal trade of the country. In 1867 the letters delivered had reached nearly 775,000,000 in the United Kingdom (being 3⅓ per cent. excess on the previous year, and averaging 144 letters to each inhabited house). The book packets were more than 102,000,000, being an increase of one-half per cent. on the previous year. The receptacles for letters were 17,225, being 1 to every 312 inhabited houses.

Whoever originated the idea of the penny post, the nation will always feel that it is to the ability, the energy, and the perseverance of Sir Rowland Hill that we are indebted for the inestimable benefits which have followed the realisation of the idea. In the history of the progress of the age his name will be always conspicuous.

The success of the Post-office, and the enlightened readiness with which every improvement is adopted and the wants of the public supplied, give us reason to hope that what many regard as a very questionable interference with private enterprise, in the proposed purchase of the telegraph property of the whole kingdom, in order to place it under one management, will prove eminently for the public benefit. The facilities possessed by the post office in having money order offices and employés who at a very slight additional expense may work the telegraph in localities in which it would scarcely pay profit to the companies to form new stations, are likely to create and satisfy the demand for numerous extensions. In populous places, from which the profits are mostly now derived (it is stated that 75 per cent. of the entire receipts are from fifteen towns, and one-half from London), the combination of the pillar-post and stamped paper for telegraphs in the suburbs, the saving of extra charge for distances in the delivery, and all over the country an uniform and cheap rate, will no doubt lead to an immense development of the system. It is highly probable that in a short time an uniform charge of 6*d*. a message of a certain length will be established. The consequence will be felt as well in the convenience of private intercourse, as in the internal trade of the country in bringing distant markets together, and, by increasing the competition, obtaining a greater approach to equalisation of prices for the great benefit of the public. It is assumed that the number of telegraph messages is increasing at the rate of 10 per cent. per annum, and that on the 1st July, 1869, the Government will start with the estimated number of 7,500,000. Supposing that present charges of 65,000*l*. a-year may be saved by amalgamation of all the lines, and allowing for various costs, for extension, &c., a maximum net revenue of 358,000*l*., or minimum of 203,000*l*. per annum is Mr. Scudamore's calculation, with which Government credit would more than raise the capital of 6,000,000*l*. required for the purchase. But it is scarcely possible that with so many interests, still to be settled by arbitration before the money bill can be brought in in the next Parliament, that even this large sum will suffice to complete the purchase. There is nothing to prevent the Government competing, if the public interest required it, without laying out so large a sum for the purchase of interests which are not vested. But besides the natural feeling of the public against the unfairness of destroying, and the risk of discouraging, private enterprises which have produced, or are calculated to produce, such good results for the country, there is no doubt that the machinery and arrangements already complete, and the facilities afforded by the railway leases, form a basis for immediate improvements which will so much the earlier repay the outlay. The other objections, that Government may use the lines for favouritism or for political purposes, that they would have the command of all the secrets of private individuals, as well as those of their public opponents, that they might harass the press by delays, or transmit news to one journal to the exclusion of another, appear either to excite no alarm, or to have been met, as in the last case, by a judicious compromise and the formation of a company to collect news for themselves. On the whole there seems reason to hope that this great experiment may be tried in the course of next year, and that no fresh agreements with the companies which would be still more costly, will be rendered necessary by delay.

Conference on Weights and Measures.

During the past year there have been several important congresses in which the British Association has been either interested or represented. The Metric Committee, which was reappointed in 1866, united its efforts to those of the International Decimal Association to obtain a special exhibition of the weights, measures, and coins of all countries in the Paris Universal Exhibition. The Imperial Commission applied to all the Governments of Europe and America to send copies of their standards, and to appoint delegates to take part in a conference to be called for a full discussion as to the best means of obtaining an uniform system for all nations. The exhibition, which appeared to excite great interest, was held in the pavilion, in the central garden. It had the great advantage of showing by contrast the singular simplicity and beauty of the metric system of weights and measures as compared with all others. The conference, at which delegates officially appointed by the Governments of all the leading countries attended, was presided over with great ability first by M. Mathieu, member of the Institute of France, and afterward by his Imperial Highness Prince Napoleon; and after a full discussion on an able report prepared by Dr. Jacobi, Member of the Imperial Academy of Sciences at St. Petersburgh, it was decided to recommend the universal and sole adoption of the metric system,—not a single voice being given against it, nor a single word said in favour of any other system. Strong resolutions were unanimously passed also at the International Statistical Congress, held at Florence in October last, recommending its universal adoption, advising that associations should be formed in all countries where it is not yet introduced, to prepare the way for it and make its advantages known, and that it should be taught in Govermental schools, and used in all post offices, custom houses, and public establishments.

In this country, where the Metric Weights and Measures Act, 1864, renders the use of the system legal, the singular anomaly still exists that no provision is made for stamping and verification by the standards, and consequently parties may be liable by one Act to the usual penalties for using such weights and measures, although by another, contracts made by them therein are lawful. The Act indeed is so defective, and the progress of the system so great, that another Act was introduced in the session just closed to make it compulsory within some given period to be fixed in committee. Mr. Ewart, together with Mr. Bazley, Mr. Baines, Mr. J. B. Smith, and Mr. Graves took charge of the bill, and after an animated debate, the second reading was carried by the large majority of 217 to 65. It was set down for committee on 1st July, but the state of public business prevented its being proceeded with. It will be one of the questions of great, if not pressing, importance for early consideration by the new Parliament.

The first report of the Standards Commission which has just been presented, shows the necessity of the establishment of the Standards' Department, which carried out one of the recommendations of Mr. Ewart's committee. Several indications are given of progress in the decimal system. The metre also has been laid down from the authentic metre in the possession of the Royal Society, and the kilogram verified by Professor Miller transferred from the Royal Observatory at Greenwich, and steps have been taken to procure a complete series of the weights and capacity measures of the metric system. But as to the probable effect of its introduction into this country, the commission have not yet had time to examine the numerous papers which have been collected, but admitting its importance, will give it their early and best attention.

In the meantime the confusion and intricacy of the weights and measures in our vast dominions in India, have led to the appointment of Commissions to introduce a thorough reform. The metric system has been recommended by Colonel Strachey, F.R.S., president of the Indian committee, as the best system for entire and exclusive adoption throughout India, and this view has been supported by two Commissions. Mr. Charles F. Gover, in a very able paper on uniform metrology for India, proves that formerly not only was the decimal system universal in India, but that the ancient measures of land and the original basis of the present system of linear measures was almost identically the same as the metre—39·3 inches (for 39·37079 inches).

The only cause for delay in introducing an uniform system in India, seems to be the idea that the imperial weights and measures will still retain their position in England, and that their system must have some easy relationship with what prevails here. But the metric system is admitted to be the best, and if it should be finally adopted here, all that vast population would be exposed to the inconveniences of a second change.

In the United States of America, the metric system is permissively legalised, but more completely than in England, by the introduction of the standards for verification. The official delegates of America have declared that the United States would follow England in making the use compulsory. If England took the lead, India and all our colonies would unite with us. The system which is now legal in whole or in part, and either compulsory or permissive, amongst 275,000,000 of people, would then comprise upwards of 450,000,000 of people using the same weights and measures, with decimal subdivisions and multiples in the simplest and most perfect form either for calculations or commercial use.

One hundred years ago such an idea might indeed seem utopian, as would also now be the notion of finding acceptance for another universal unit. But when by peculiar circumstances such rapid progress has been made towards uniformity, it is practical wisdom to seize every opportunity to promote it. In science, in commerce, in education, in international intercourse, in statistical inquiries, it is difficult to picture the vast benefits that would result from the adoption of one and the same unit by all civilised nations.

Monetary Conferences.

Far greater difficulties and differences of opinion lie in the way of a monetary unit of account, or even uniformity of metallic currency for the leading commercial nations; yet a great movement has been going on therein during the past year. The conference, in connection with the Universal Exhibition at Paris, over which Prince Napoleon presided, discussed and agreed to resolutions, that the different Governments should adopt a common base or unit in the issue of their gold coins; that it should be of the same fineness, nine-tenths; and that in each country there should be one piece at least equivalent to one of the pieces in another country, so that there might be a point of contact in the currencies of all countries. The 5-franc piece in gold was finally adopted as the basis, since the multiples thereof would very nearly accord with the monetary units of several countries. M. Wolowski, the distinguished economist, defended with great eloquence and energy the double standard of silver and gold, but he found no seconder. A single gold standard, and everywhere the decimal subdivision of the unit were carried as the nearest means of obtaining some coin everywhere current and values easily translated into those of foreign nations.

But the International Monetary Conference, which was called about the same period in June of last year by the French Government, is likely to produce still more definite results. All the leading Governments of Europe and America sent official delegates to represent them. The basis taken by the conference, subject to such improvements as might be suggested, was the convention concluded the 23rd December, 1865, between Switzerland, Belgium, France, and Italy, for a common currency; by Article 12 of which convention the right of accession was reserved to any State which would accept the obligations and the monetary system of the union as far as regards the gold and silver coins. The delegates did not appear to have any authority to bind their respective Governments, except that of Austria, for whom the Baron von Hock at the end of the conference negotiated and signed a preliminary treaty of adhesion to the Convention of 1865. In the early part of 1867 the Papal Government had joined the Convention, and in April of the same year the currency of Greece was remodelled on the same system.

The French Government were anxious to obtain some definite answers to the propositions of the congress, in order to call a new congress with more extended powers; but no definite time was fixed for the replies, some voting for replies by the 1st October last, and Great Britain for an extension to the 1st June of this year. The report of the English delegates, Mr. Graham, Master of the Mint, and Mr. Rivers Wilson, of the Treasury, has been referred to a royal commission for their opinion whether Great Britain would be justified in making any changes in her currency which would allow in any way of her joining the monetary convention. This report, with the evidence taken, is anxiously expected.

It does not appear that a merely international currency of one or more coins would compensate for the trouble and inconvenience of altering even to a slight degree (one grain is all that would be required) the quantity of pure gold in the pound sterling. But a common unit of account would offer manifold advantages. An international unit of 10 frs., which would have many advantages over 5 frs. as the smallest gold coin, subdivided decimally, would at once give in all commercial quotations, and in all statistical records precisely the same figures. All nations who accepted it would use the same language of value, and instead of the 5, 15, and 25 frs., as suggested by the congress, which would require constant computations in the translations of different languages, only 1, 10, or 100 would be used, in which values in every country would always be expressed in the same figures.

If pure theory were to be insisted on for all the nations adopting the metric system of weights and measures, 10 grammes of pure gold, without alloy, should be the unit of value = 34·44 frs., or very nearly 1*l.* 7*s.* 6*d.* But this would necessitate the coinage of all their gold and silver afresh, the gold alone being estimated to be 280,000,000*l.* sterling in those States which have joined the convention, as well as 360,000,000*l.* in other continental States which may join it hereafter, and 60,000,000*l.* in the United States.

In Great Britain the gold coinage, though uncertain in amount, is not generally reckoned at more than 100,000,000*l*.

We must, therefore, take a practical view of the proposition, and it would not be to the credit of this country, with its great influence in commerce, and its pretensions to a high place in social progress, to withdraw from conferences in which other nations are taking so active a part, in questions so likely to promote the peaceful intercourse and prosperity of all.

Statistical Congress.

The other congress in which this Section is particularly interested, was the International Statistical Congress, which, after four years since its last meeting in Berlin, was invited by the Government of Italy to meet in Florence in the early part of October last year. The statesmen, learned professors, and social reformers of Italy formed a larger body of natives, 632, with 85 foreigners, than even the Congress in London in 1860. The King had nominated his eldest son, Prince Humbert of Savoy, as general President, and his Excellency the Minister of Agriculture, Industry, and Commerce (S. de Blasiis), took a most active part in the proceedings. The effect of these congresses, of which six have been held since 1853, is seen in the great improvement in the form of collecting Government statistics of all kinds. By uniformity of methods and principles, not only may the relative progress of nations be compared, but the phenomena of political and social economy examined under different conditions and varying aspects. Thus the law of the production and distribution of wealth, of the growth or decay of population, the causes of early or late marriages, the effects of emigration on the country left or adopted, the best means of the prevention or suppression of crime, the evil effects of great standing armies, interfering with the production, or causing wasteful consumption in a country, and numerous other questions of the highest interest to society at large, may be traced on the broad map of a continent, instead of the narrow limits of a single country.

At each successive meeting the able and earnest men, who as Government officials really have influence to carry out the resolutions agreed to, have discussed nearly all the subjects on which national prosperity depends. The summaries of the previous reports by Dr. Engel, of Berlin, and Dr. Maestri, of Florence, are full of matter for reflection, laying down the principles on which every possible statistical question ought to be studied.

An attempt is now being made by some of the leading members, animated and guided by M. Quetelet, who may be considered the founder of these congresses, to collect on an uniform plan the comparative statistics of all nations under the principal heads. The first volume, on population, was presented by M. Quetelet at the last congress, and is an admirable *résumé* of hundreds of scattered official volumes. It is to be followed by other compilations in different branches of statistics, showing that these meetings have not ended in idle discussions, but will assist the philosopher in his studies as well as the practical man in his efforts to promote the social improvement of the people.

On the suggestion of M. Quetelet a section will be formed in the next congress especially to examine statistical subjects in their direct relation with the theory of probabilities. The laws of the recurrence of events will thus be eliminated, and many questions which are now obscure may, by due value being given to the weight of observations, be reduced to correct or approximate theory.

Such congresses and meetings like the present enable all those who are engaged in a common pursuit, to benefit by the labour and skill, by the depth of thought, or wide experience of their fellow-workers in the same field. They bring the kindly feelings of friendship to the aid of scientific investigations; they allow no man to feel that he can repose, as if he had done enough for society, for he finds in the brief interval since we last met, what new questions have agitated the world, and how he must bestir himself to keep pace with the intellectual progress of the age; they point the way to unexplored tracts of knowledge; they utilise the smallest contributions of thought whilst filling the mind with suggestions of the extent and variety of the problems which still remain to be solved in the social condition of man. The domain of statistics is so vast, that we should welcome any new labourers who will cultivate the new fields of research constantly opening up. If not strictly a science, it is at least a method of investigation which requires to be conducted in a scientific manner, and in an earnest spirit of search for truth. Even undeniable facts may be so collected as to serve the cause of prejudice, to perpetuate error, or to conceal the laws which they should reveal. In social science and political economy, statistics may be considered the collection of experiments, by the results of which we observe the hidden workings of the laws which regulate the social condition of man and his progress in civilisation. The growth and decay of population, the freedom of capital, and the rights of labour, the duty of voluntary or enforced education, the extent of Government interference in labour or manufactures, the competition of prices, the true principles of commerce, the most effectual means of suppression or prevention of crime, the theory of taxation and national loans, and multitudes of similar questions are all governed by subtle laws affecting the free will of man checked and kept in place by similar action in others, of which we catch a glimpse sometimes by their irregular action in enforced or abnormal conditions, and sometimes by our having discovered and acted in harmony with the natural law which governs them. But as society is perpetually changing what we have discovered and thought to be truth, seems frequently inadequate to account for the new phenomena presented. It is only by extending our observations from the narrow sphere of a single country or a single class to all countries and all classes, by an uniform collection of statistics as is now being done by all the Governments of Europe, by noting differences as well as analogies, and confessing and correcting errors, and comparing the operations of the same causes under various conditions of interference, that we shall throw light on the many unsolved problems of social and political economy which modern civilisation presents.